PRO GEO
GEOTECHNICAL CONSULTANTS

SHORT PRESENTATION

BARCELONA, SPAIN

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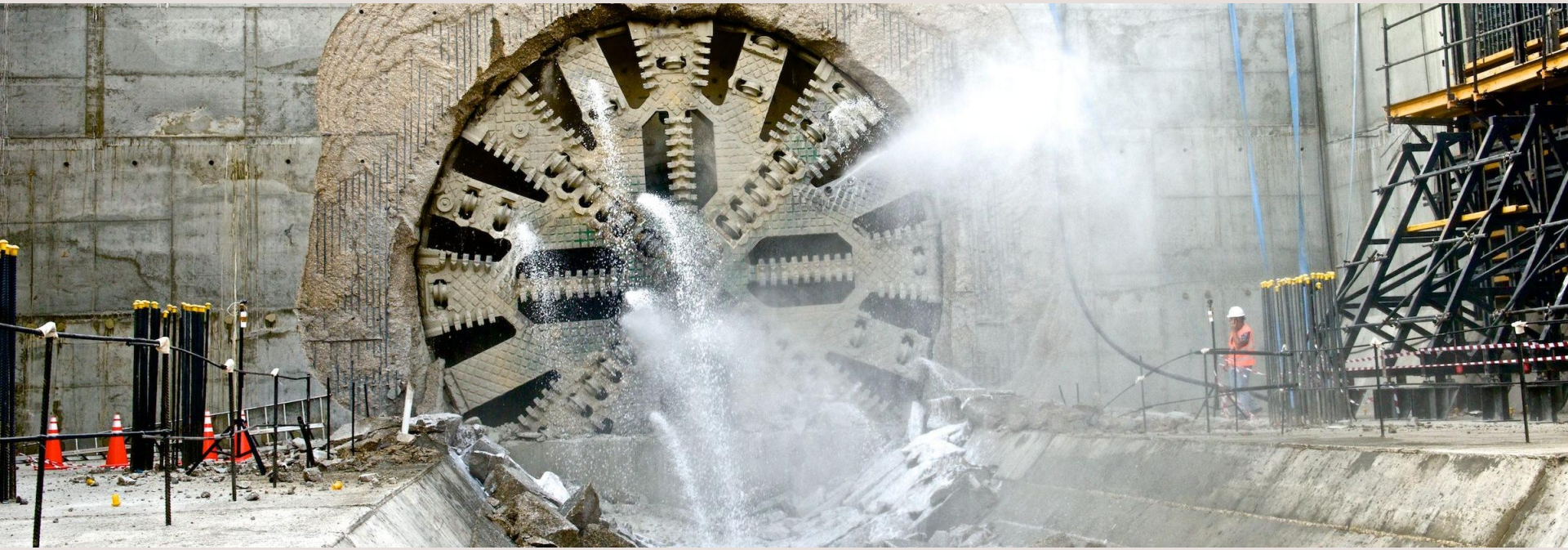

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PRO GEO
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About us

PRO GEO GEOTECHNICAL CONSULTANTS is an engineering company specialized in the analysis of complex problems in Geotechnical Engineering and Geosciences. The company is based in Barcelona (Spain) and was created in 2011.

We have an extensive international experience and we have established stable collaborations with building and consultancy companies.

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Technical services (I)

PRO GEO provides the following geotechnical design services:

- Underground engineering design (NATM and TBM tunnelling).
- Harbour and onshore geotechnical design.
- Geotechnical monitoring design and analysis.
- Advanced foundations design.
- Use of *back analysis* techniques.

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Technical services (II)

- Offshore geomechanics (wind farms).
- MSW and industrial landfills design.
- Seismic risk analysis.
- Liquefaction analysis.
- Soil-structure interaction in dynamic analysis.
- Soil improvement techniques.

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Team

Our team is composed by **Civil and Geological Engineers** with a relevant experience.

The company is headed by **Dr. Angel Garcia-Fontanet PEng CEng** which has more than 20 years experience in Civil and Geotechnical Engineering. He was awarded with a doctoral degree in Geotechnical Engineering in 1998 and is licensed in the UK and Canada.

PRO GEO's team also includes **Professor Dr. Marcos Arroyo** (Technical University of Catalonia - UPC). He obtained his PhD in Bristol University and he has extensive research experience in Geotechnical Engineering. He is currently part of the editorial committee of *Géotechnique*, one of the most prestigious journals in its field, and he participates in the Eurocode 7 technical committee.

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Relevant Projects

A. Toronto – York Spadina Subway Extension (**CANADA, 2011-2014**)
B. Barcelona – *Plaça de les Glòries* Tunnel (**SPAIN, 2016**)
C. Toronto – Eglington Crosstown Light Rail Transit (LRT) (**CANADA, 2016-2017**)
D. Bolaños Tunnel – High Speed Rail (**SPAIN, 2012-2015**)
E. São Jose Do Norte Harbour (**BRAZIL, 2013-2015**)
F. Cadarache – ITER Nuclear Facility (**FRANCE, 2013-2014**)
G. Súria Mine – Connection Gallery (**SPAIN, 2016**)
H. Barcelona Harbour – Tramer Terminal (**SPAIN, 2015-2016**)
I. Salamanca – Barruecopardo Tungsten Deposit Foundations (**SPAIN, 2017**)
J. Riyadh Underground – Lines 3 & 5 (**SAUDI ARABIA, 2015-2016**)

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A. Toronto – York Spadina Subway Extension (CANADA, 2011-2014)

- The adopted design was a twin tunnel with two 6.05 m diameter Earth Pressure Balanced (EPB) tunnel boring machines.
- Stations were built with cut and cover procedure.

Important technical improvements and time savings have been achieved.

PROGEO: Settlement predictions, compensation grouting procedures, stations geotechnical designs, EPB performance assessment and clay clogging problems.

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B. Barcelona – *Plaça de les Glòries* Tunnel (SPAIN, 2016)

- The underground tunnel at *Plaça de les Glòries* is constructed by a *cut and cover* procedure in a densely populated urban area.
- Some stretches of the construction cross under four underground railway infrastructures, where conventional tunneling techniques are required.

PROGEO: Geotechnical survey design, cut&cover geotechnical design, 2D and 3D geotechnical modeling.

Our experience has permitted to carry out the consultancy activities related with the geotechnical and hydrogeological design.

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C. Toronto – Eglinton Crosstown Light Rail Transit (LRT) (CANADA, 2016-2017)

- The Eglinton Crosstown LRT is a light rail transit line that will run across Eglinton Avenue between Mount Dennis (Weston Road) and Kennedy Station in Toronto, Canada.
- This 19-kilometer corridor will include a 10-kilometer underground portion, between Keele Street and Laird Drive. The Crosstown will have up to 25 stations and stops.

PRO GEO underground design experience has helped our client in the geomechanical modelling of different stations.

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D. Bolaños Tunnel – High Speed Rail (SPAIN, 2012-2015)

- Bolaños tunnel is a 6.8 km twin High Speed Rail tunnel. Each tube has 11 m diameter and is bored by a simple shield TBM. The maximum overburden is about 200 m with a water load of 140 m.

PROGEO: Tunnel dowels geotechnical design, cross passage tunnels design, landfills geotechnical design.

An important improvement in dowels design was achieved.

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E. São Jose Do Norte Harbour (BRAZIL, 2013-2015)

- São Jose do Norte dock is 880 m long and 25 m wide. Dredge level is 12 m below sea surface and has been built to allow offshore oil structures.
- High values of the design crane loads (up to 200 kPa).

PROGEO: Project coordination, geotechnical survey design, soil improvement techniques, geomechanical modeling, geotechnical monitoring results analysis, pile static load test definition.

Our expertise has allowed a relevant improvement in dock previous design.

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F. Cadarache – ITER Nuclear Facility (FRANCE, 2013-2014)

- ITER is a nuclear facility located in Cadarache (France). It is a large-scale scientific experiment that aims to demonstrate the technological and scientific feasibility of nuclear fusion energy. In the international consortium takes place the European Union, USA, Russia, China, Japan, South Korea and India.

PRO GEO has assisted one of the main contractors in the geotechnical design and application of Rock Mechanics principles in order to obtain simple and reliable results.

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G. Súria Mine – Connection Gallery (SPAIN, 2016)

- The connection gallery at Súria Mine connects the Mine of Cabanasas to the facilities where the material is treated. The gallery is 4700 m long and the maximum depth is 800 m.
- The gallery cross section is elliptical, with 9 m wide and 5.5 m high at more than 500 m depth.

PROGEO: Assessment of the primary lining design for short and long term (3D and 2D models).

Our contribution helped to verify the primary lining for the different types of geotechnical and geometric conditions.

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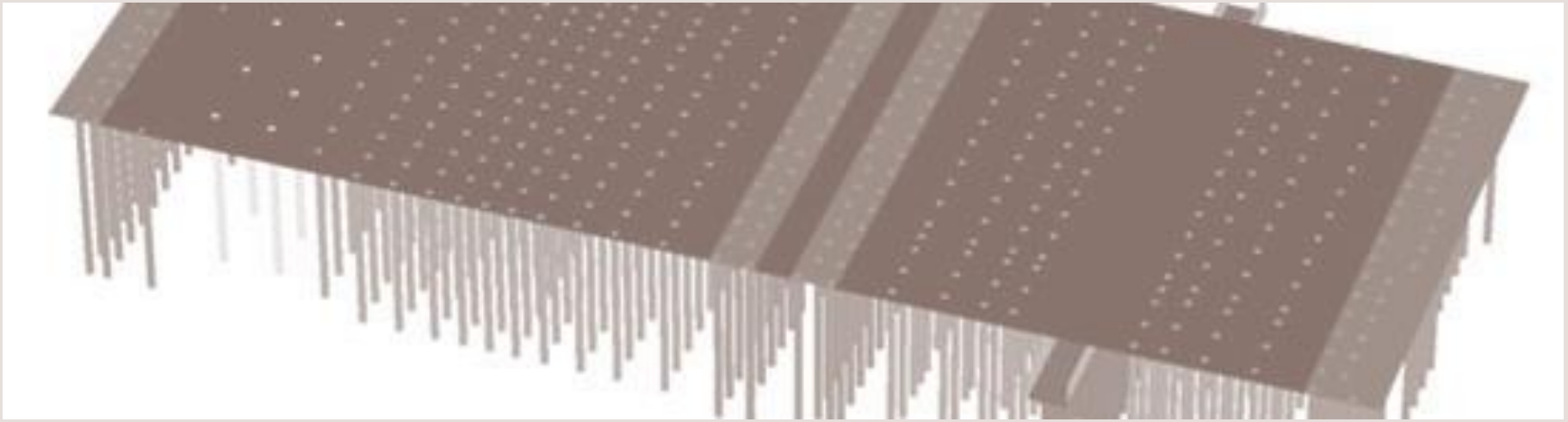
H. Barcelona Harbour – Tramer Terminal (SPAIN, 2015-2016)



- In this project, the construction of a new terminal aimed for the salt storage at Barcelona Harbour is carried out. Two warehouses with a surface of 14900 m^2 and 12300 m^2 respectively, with 21 m high mounds of salt, are being constructed.

PROGEO: Optimization of the pile slab foundations, 2D and 3D geomechanical model, affections to near dock, driven poles static and dynamic load tests.

Our contribution helped to optimize the piled slabs and a relevant cost saving has been achieved.

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I. Salamanca – Barruecopardo Tungsten Deposit Foundations (SPAIN, 2017)

- A new processing facility for the mined ore will be constructed. The new process and site facilities require the construction of significant civil engineering structures, foundations and infrastructure.

PROGEO: footing foundations and reinforced concrete slabs (3D geomechanical models), the design and supervision of the complementary geotechnical survey.

PRO GEO experience has helped our client in the geotechnical and structural foundations design of a part of the mine project.

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J. Riyadh Underground – Lines 3 & 5 (SAUDI ARABIA, 2015-2016)

- Line 3 and 5 of Riyadh underground are 41 km and 12.9 km long and they are bored by a TBM tunnel (EPB). Along the TBM tunnel there are some underground stations and evacuation or ventilation shafts with connecting galleries.

PROGEO: 3D geomechanical model of the intersection between TBM tunnel and galleries connection with the pertinent excavation process .

Our contribution has helped to predict the behavior of the connection between the TBM tunnel and the connection gallery.

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Clients (I) – Building companies

Clients (II) - Consultants

Bridge Technologies

BAC ENGINEERING CONSULTANCY GROUP

PEDELTA

IDP

GEOPLANNING

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JG Consultores en Geotecnia e ingeniería del Terreno S.L.

Clients (III) - others